USING MHEALTH DATA TO IMPROVE THE MANAGEMENT OF CHRONIC PAIN

A Thesis

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Master of Science in Health Informatics

by

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ABSTRACT

Chronic pain is widespread and mHealth provides a novel solution to the management of pain through the use of smartphone technology. The purpose of this research is to determine whether mobile health data is useful for clinicians who are frequently involved in the management of chronic pain, and to assess their data needs. We selected orthopedic surgeons and physical therapists as a population likely to be interested in the management of chronic pain. We conducted semi-structured interviews with physical therapists and orthopedic surgeons to better understand the gaps in needs and knowledge. Qualitative thematic analysis was performed using the interview transcripts to inductively determine themes in the data. Thematic analysis of the data revealed significantly different data needs between physical therapists and orthopedic surgeons, increasing focus on functionality and outcomes, and the importance of compliance and efficiency. Overall, physical therapists responded enthusiastically to the use of smartphone interventions in their practice. The promise of mHealth presents a great opportunity for patient management when patients are in their everyday contexts, rather than solely in the clinic.

BIOGRAPHICAL SKETCH

Nathan is a candidate for the MS in Health Informatics at Weill Cornell Graduate School of Medical Sciences. His degree will be conferred in August 2016. Previously, he worked as a Research Technician at Weill Cornell Medicine. He received his undergraduate degree from Columbia University in May 2014.

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INTRODUCTION

About one in four Americans suffer from chronic pain, which is a major problem in healthcare.[1] Now it is one of the most common causes of long-term disability.[2] Chronic pain can lead to poor medical outcomes as well as increased cost and utilization of healthcare services.[1,3] Furthermore, chronic pain requires long-term treatment plans in both traditional and outpatient settings.[4]

The increasing pervasiveness of mobile technologies creates an unprecedented opportunity for novel solutions in healthcare. One solution is mHealth, or mobile health, which refers to the use of technologies such as smartphones and wearable devices in healthcare.[1] As of 2014, 64% of U.S. adults own a smartphone, and 83% of smartphones are always turned on and with the user.[5] The tendency for people to carry their phones with them everywhere makes it possible for continuous symptom monitoring.[2] Considering the exponential growth of the use of smartphones, their potential role in healthcare is becoming more evident.[6]

mHealth can change healthcare because of its high reach and low-cost solutions, especially for chronic pain.[1] One study showed that using text messages increased healthy behaviors and reduced pain perception and medication adherence in low-income, elderly, and minority groups.[2,7,8] Another study claims that adherence to chronic pain management is critical to achieving improved health outcomes, quality of life, and cost-effective healthcare, and mobile technologies can be a solution.[2] Over the next two years, the Food and Drug Administration (FDA) projects that more than 500 million smartphone users will use mobile health applications.[1]

Smartphones are becoming an essential component of mHealth for several reasons. First, as people become accustomed to carrying their phones with them at all times, smartphones can improve patient compliance and

management of treatment plans.[3,9] Throughout the day, patient-generated health data can be tracked in real time when the person is in their native environment, reducing recall bias and reporting errors.[10] Second, smartphones can enhance the service delivery process by addressing health concerns when the problem is occurring.[11] For example, a physical therapist can receive data from a patient in real time about their pain and address the issue accordingly. This can produce better health outcomes that are both effective and scalable. Third, smartphones can change patient behavior by actively engaging the patient in their self-management skills, tracking, and sharing of information about their health to their provider.[4]

Literature on the use of mHealth devices for chronic pain is limited because the technology is so nascent. However, there is growing interest in using such new technologies for the management of chronic pain.[4] Health professionals acknowledge that different patients require different levels of care, and episodic care in clinical and hospital-based settings is not enough for chronic disease management.[12] Thus, there is a need to extend care into where "health happens" in the context of an individual's lifestyle.[12] This includes where people work, shop, sleep, eat, exercise, and communicate.[13] The proliferation of smartphones apps makes mHealth a new reality, but its impact on healthcare is not yet known.[2] Nonetheless, the growing popularity of mobile devices and its ability to reliably and safely collect data outside of the clinical environment is promising.[11]

The goal of this qualitative study is to determine whether mHealth is useful for physical therapists and to assess their data needs. We believe that mHealth has the potential to achieve lower healthcare costs and improved health outcomes for chronic pain patients. Through semi-structured interviews with clinicians, we hope to better understand what physical therapists care about

when it comes to chronic pain management, and to contribute to the limited body of literature on this subject.

METHODS

Physical therapists and orthopedic surgeons with experience treating patients with low back pain were recruited from several practices. A snowball sampling approach was utilized in which co-investigators in this study suggested the names of potential participants for the interview. A total of 10 clinicians were recruited for the interviews: 8 physical therapists and 2 orthopedic surgeons.

A series of semi-structured interviews were conducted with these clinicians. Although an interview script was used, the interviews were conducted as guided conversations to probe and explore new topics that arise. The interviews were audio recorded and transcribed. Qualitative thematic analysis was used to inductively identify, analyze, and report patterns within the data.[14] This data-driven approach was used to find themes existing within the data without trying to fit into a pre-existing coding frame.

The Institutional Review Board of Weill Cornell Medicine approved this study. All interview participants gave written informed consent. The Health Information Portability and Accountability Act (HIPAA) does not apply to mHealth data in mobile devices, but would apply if it interfaced with an electronic health record (EHR) system, which is not the case for this study.

In the interview, in order to reduce potential bias in responses, the apps were described to the clinicians as "being developed at the Cornell Tech campus," not by the researcher conducted interview. Passive mobility monitoring and active questionnaires are the main functions of this app.[15] Passive data collects as the app runs in the background on a smartphone, whereas actively collected when the user purposefully engages in the smartphone app. These apps gather continuous streams of data on the individual's personal health through objective physical activity data (e.g. mobility and location) and also self-reported surveys with regards to pain intensity and activities of daily living

(YADL), and completion of home exercise programs. The apps must be easy to use and intuitive for it to be useful in the real world, and thus feedback on the technical direction of the apps was crucial.[16]

RESULTS

Three general themes about emerged from the semi-structured interviews, providing a story about how the different themes in the data fit together.

Theme 1: Physical therapists and orthopedic surgeons have significantly different data needs.

Early on in the interview process, we found that physical therapists and orthopedic surgeons had starkly different perspectives on data needs. Orthopedic surgeons are not as interested in what patients are doing outside of the clinic. Table 1 shows a quote from a physical therapist and an orthopedic surgeon, which are representative of the views from each side.

Table 1. Interview excerpts from a physical therapist and orthopedic surgeon responding to the question, "Do you want patients to keep you updated?"

PT #6	**OS #1**
"Oh yeah, absolutely. They have my work cell phone, they have my personal cell phone. They have to call me if there are any changes, whenever they are uncomfortable or have any questions."	"Absolutely not, unless they have issues. I have no time."

Orthopedic surgeons are constantly overwhelmed with information. Their priority is to ensure that the surgery is completed without complications and that the patients are doing fine in the short-term. When asked about patients keeping them updated with their health, orthopedic surgeon #1 stated, "Absolutely not,

unless they have issues. I have no time." On the other hand, physical therapist #6 said, "Oh yeah, absolutely." Therapy and rehabilitation are the responsibility of physical therapists, so they are very interested in what patients are doing outside of the clinic.

Increased clinical workload and workflow are major concerns. With hundreds of tests that need attention on weekly basis, information overload is a real problem, and adding more data could damper workday efficiency. It is crucial that the data is presented in an easy to understand format and that the volume of data is well thought out. There did not appear to be a relationship between lack of familiarity with technology and the willingness to try it.

Theme 2: Reimbursements increasingly focus on outcomes, particularly functionality.

Multiple physical therapists voiced their concerns about reimbursement rates, which is outlined in Table 2.

Table 2. Interview excerpts from physical therapists responding to the question, “Can you talk about insurance coverage for physical therapy?”

PT #2	“Reimbursement rates aren’t going up. I'm getting reimbursed X and I need Y for these hours.” [X < Y]
PT #3	“The functional aspect is very important to the payers. Insurance companies want to pay for less amount of visits.” [Viewing YADL slide]
PT #7	“Being able to be reimbursed [is a challenge]. Insurance companies are tightening down on outcomes. For example, [PTs] should be able to get a total knee replacement patient better in X amount of visits.”
PT #8	[Initial consultation] “I will ask a patient how far they can walk, how many blocks, how much weight they can carry… Insurance companies are interested in this information, and it would be helpful to have this information beforehand.”

For example, physical therapists #2 and #7 were concerned that they weren't being fairly compensated for their therapy hours, and that this is becoming an increasing challenge. This is because the healthcare system is gravitating towards a system where payment is determined by positive health outcomes, rather than number of visits.

Insurance companies care about functionality. Reimbursements are given one flat fee regardless of actual therapy hours (e.g., 45 minutes vs. 2 hours) in an effort to tie services to patient outcomes. As described by physical therapist #3, the goal is to decrease the number of visits. Benefits of focusing on functionality include more attention to patient outcomes, thus patients get more out of each visit. Also, this will reduce the number of visits and unnecessary therapy hours. Problems are that the insurance companies may deny claims that go beyond regaining function. For example, athletes may not be covered for therapy towards regaining previous competitive ability. Therefore, payer reform is a critical issue. We have a reimbursement system that does not cover many nonpharmacological modalities.[18] Since there is a $1,960 therapy cap for physical therapy services, sometimes it's not enough to fit the patient's needs. Physical therapist lobbying groups want to get the cap overturned.

Theme 3: Physical therapists care about compliance and efficiency.

Physical therapists universally stated that compliance to home exercise programs is the most important factor in the treatment of patients with chronic pain. Table 3 details the responses of physical therapists in regards to their biggest challenges.

Table 3. Interview excerpts from physical therapists responding to the question, “What are you biggest challenges?”

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PT #1	“Patient compliance is the number one issue. Without patient compliance in an orthopedic setting, you don't have a positive outcome, and that has been proven in studies over and over again.”
PT #4	“Patients who are compliant with home exercises, taking pain medications – their outcomes are usually very good. For patients that are not compliant, it can extend their therapy out.”
PT #5	“We want to see if patients will take responsibility for their health problems. We don't want a co-dependent relationship.”
PT #8	“Embracing the EMRs and new technologies has growing pains. For us to respond to emails is tremendously time-consuming because we cannot type quickly. It is a huge challenge because our time is so limited, and it slows down efficiency.”

All the physical therapists touched on the issues of compliance and efficiency. It is critical that patients perform these exercises at home, but physical therapists cannot know for sure if they are truly performing these exercises. Thus, having a smartphone app that can record and notify the clinician that these exercises are being completed can mitigate this issue. Physical therapists are very interested in compliance because they want to know what patients are doing outside of their therapy visits. There is enthusiasm for activity and location data, as well as home exercise program compliance.

As for efficiency, physical therapists already have a lot of data to document. Therefore, new data must have seamless workflow integration. There are growing pains that come with new technology, and thus clinicians may be apprehensive when it comes new IT adoption. Nonetheless, all the interview participants were willing to try novel smartphone applications for the management of their patients with chronic pain.

DISCUSSION

For this study, we wanted to know whether mHealth data could be useful and actionable for clinicians who treat patients with chronic pain. Semi-structured interviews were conducted with physical therapists and clinicians in order to better understand their data needs and receive feedback on the technical direction of the smartphone apps. Thematic analysis of the interviews revealed three major themes: home monitoring apps are useful for physical therapists but not orthopedic surgeons; the main outcome focus must be on patient functionality in order to help therapists document outcomes that could help them get reimbursed; and the interventions must improve compliance and efficiency.

The aim is to have the smartphone app fit to allow for easy IT adoption in both the clinician's workflow and the patient's lifestyle. Younger users can readily adopt new technologies and learn quickly because technological proficiency levels are higher from the very beginning.[17] Having enough resources such as staff can be valuable, but perhaps beyond the scope of some smaller practices.

mHealth provides a richer view of health through personalized data-driven insights. The use of mobile apps in pain management is becoming more evident, but there is a lack of regulation and evidence that should be noted. The greatest benefit of mHealth is that patients can manage their conditions in their daily environment at their convenience and fit within the busy lives of both patients and clinicians. The data can provide a new understanding of health to all persons involved through better monitoring of their pain levels and associated symptoms, and thus allow for timely interventions by the provider.

Stereotypes and other misconceptions about data and IT adoption were proven wrong. Studies have already shown that older adults with chronic pain are interested in using mHealth technologies to help with their pain problems.[19] These interviews support these studies and show that there is not a mismatch

between the technology and the user. The use of passive data collection is especially critical for pain patients who may have difficulty actively interacting with their smartphones.

There is a gap in the individual's ability to understand the data and abstract new meaning, and this must be resolved to change a person's health. Data must be shared with sufficient context and alleviate burden in order to be useful.[20,21] Reliability must be assumed in order to have this data be accurate and functional.

Social support is a critical component of the treatment process. Studies show there is a causal relationship between social support and pain because it reduces pain perceptions and is beneficial for coping, recovery, and rehabilitation.[7] Professional health support that goes beyond messaging prompts is critical to the coaching process because the patients know they are being monitored.[9]

Finally, we need to establish a payment or reimbursement model for mHealth. This must focus on the workflows rather than the technologies. mHealth data can promote research through more insights about pain about diverse patient populations. These data can be de-identified to allow investigators to reuse the data to investigate further research questions.[11]

There were several limitations to this study. The sample was small, non-random, and limited to clinicians within the network and primarily in New York. This sample of respondents is a convenience sample and may affect the generalizability of the findings in other populations. Finally, because the study was qualitative, this should be considered a descriptive and hypothesis-generating study.

CONCLUSION

Health interventions such as mHealth that reach beyond traditional care can revolutionize patient management and treatment for chronic pain patients. mHealth allows data to be shared at any time, rather than just a visit to the clinic and outside of traditional settings. Furthermore, mHealth data can reveal whether there are warning signs of health issues, or indicate that health is improving. A future goal is to have mobile technology deliver high quality health care to areas where it is limited or may not exist. By proving better health outcomes through mHealth technologies, funders will be more willing to invest and adopt these interventions on a broader scale.

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